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VULIS, L. A.

PHASE I BOOK EXPLOITATION SOV/5179

Alma-Ata, Kazakhstan. Universitet.

Issledovaniye protsessov perenosa. Voprosy teorii otnositel'nosti (Study of Transfer Processes. Problems in the Theory of Relativity) Alma-Ata, 1959. 236 p. Errata slip inserted. 1,000 copies printed. (Series: Its Trudy)

Sponsoring Agency: Ministerstvo vysshego obrazovaniya SSSR and Kazakhskiy gosudarstvennyy universitet im. S.M. Kirova.

Editorial Board: V.P. Kashkarov, N.D. Kosov, and N.M. Petrova; Resp. Ed.: L.A. Vulis; Tech. Ed.: L.D. Kashkarov.

PURPOSE: This collection of articles is intended for research physicists and engineers. It can also be used by instructors and students at universities.

COVERAGE: The articles of this collection contain the results of 19 studies in transport problems and the general theory of relativity made from 1956 to 1958 by the staff of the kafedra obshchey fiziki i teoreticheskoy fiziki Kazakhskogo universiteta im. S.M. Kirova (Department of General Physics and Theoretical

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Physics of the S.M. Kirov Kazakh State University). The articles are arranged in two groups. Group one contains 16 articles concerning the research activity of the teplofizicheskaya laboratoriya pri kafedre obshchey fiziki (Heat Physics Laboratory of the Department of General Physics) in the investigation of transport processes of matter, impulse and energy; group two contains three articles reporting on studies of the Department of Theoretical Physics on problems of the theory of relativity. Article one of the collection is an introduction and reviews the problems of transport processes and gives a fairly detailed bibliography of contributions of members of physics department of Kazakh State University. No personalities are mentioned. References accompany each article.

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Vulis, L.A.

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10(2) PHASE I BOOK EXPLOITATION SOV/2271

Soveshchaniye po prikladnoy gazovoy dinamike. Alma-Ata, 1956

Trudy (Transactions of the Conference on Applied Gas Dynamics) Alma-Ata, Izd-vo AN Kazakhskoy SSR, 1959. 235 p. Errata slip inserted. 900 copies printed.

Sponsoring Agency: Kazakhskiy gosudarstvennyy universitet imeni S.M. Kirova.

Ed.: V.V. Aleksandriyskiy; Tech. Ed.: Z.P. Rorokina; Editorial Board: L.A. Vulis (Resp. Ed.); V.P. Kashkarov, T.P. Leont'yeva, and B.P. Ustimenko.

PURPOSE: This book should be of interest to scientists and engineers working on problems of applied gas dynamics and may be of use to students.

COVERAGE: This book presents reports and brief summaries of the discussions which took place at the Conference on Applied Gas Dynamics in Alma-Ata in October 1956. The conference was subdivided into three areas of applied gas dynamics: jet flows of fluids and gases, the

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aerodynamics of heating processes, and the discharge of a fluid. The practical value of the "Transactions of the Conference" consists in the development of theory, methods of technical calculation and methods for systematic measurement applied to heating, furnace, and other industrial processes for which, in most cases, aerodynamic phenomena are decisive factors.

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APPROVED FOR RELEASE: 09/01/2001 CIA-RDP86-00513R001961310013-6"

S/194/61/000/009/011/053
D222/D302

9,7000

AUTHORS: Vulis, L.A. and Luk'yanov, A.T.

TITLE: Electrostatic integrator

PERIODICAL: Referativnyy zhurnal. Avtomatika i radioelektronika, no. 9, 1961, 15, abstract 9 B100 (V sb. Issled. protsessov perenosa. - Vopr. teorii otnositel'nosti, Alma-Ata, 1959, 65-88)

TEXT: The operating principles of an integrator intended for solving partial differential equations of the heat conduction type are described. The main operating part is a collection of capacitors which imitate a discrete (finite-difference) representation of the problem. For this purpose a definite number of elements form part of the integrator, each of them corresponding to a certain part of the physical system investigated. An element consists of two series connected capacitors which are in turn connected to adjacent capacitors; one switching cycle corresponds to one unit of

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Electrostatic integrator

S/194/61/000/009/011/053
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time interval. The system provides for the specification of sources, and for solving problems with variable coefficients. The theoretical circuit diagram of the device, containing in addition to the capacitor, a switch, stabilized supplies and measuring instruments, is described. Examples show how the problem of cooling plates is solved. 11 figures. 2 tables. 11 references. [Abstracter's note: Complete translation]

B

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VULIS, L.A.

Effect of pulsation of temperature on the rate of turbulent combustion.
Izv.AN Kazakh.SSR. Ser.energ. no.1:66-70 '59. (MIRA 12:11)
(Combustion)

VULIS, L.A.; USTIMENKO, B.P.

Calculating heat transfer to liquid metals. Izv. AN Kazakh. SSR. Ser. energ. no.2:102-110 '59. (MIRA 12:7)

(Heat transmission) (Liquid metals)

VULIS, L.A.; KOSTRITSA, A.A.

Hydraulic analogy of the diffusion of neutrons and critical state of a nuclear reactor. Report No.1. Izv. AN Kazakh. SSR. Ser.energ. no.2:111-127 '59. (MIRA 12:7)
(Nuclear reactors--Electromechanical analogies)

VULIS, L.A.; KOSTRITSA, A.A.

Hydraulic analogy of the diffusion of neutrons and critical state of nuclear reactor. Report No.2. Izv. AN Kazakh. SSR. Ser.energ. no.2:128-138 '59. (MIRA 12:7)
(Nuclear reactors--Electromechanical analogies)

67148

~~28(2)~~ 16.6800 SOV/31-59-9-8/21

AUTHORS: Vulis, L.A., Isayev, N.U., and Luk'yanov, A.T.

TITLE: Static Analog Devices 16

PERIODICAL: Vestnik Akademii nauk KazSSR, 1959, Nr 9, pp 53-58 (USSR)

ABSTRACT: The article deals with an entirely new type of analogs, the static electrointegrators (SEI). Having been under development at the Problemnaya teplofizicheskaya laboratoriya Kazakhskogo universiteta (Laboratory for Thermal and Physical Problems of the Kazakh University) since 1957, they greatly simplify the computing methods and at the same time widen the scope of problems to be investigated. The static electrointegrators have already been used for computing diffusion of neutrons as well as for solving nonlinear problems pertaining to the theories of heat conductivity and hydrodynamics (Figure 2). The article also mentions two additonal SEI models,

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Static Analog Devices

the first being practically an electric analog of D. V. Budrin's hydrostatic integrator and the second an SEI with an ohmic-type, moving computor device (Figures 3 and 4). The latter has a great advantage as it can make calculations by dividing the space-time component into as many elements as desired. In addition to this, the SEI with an ohmic-type moving computor device has small dimensions, its only bad point being the necessity to make intermediate entries. The article also mentions the Problemnaya laboratoriya kafedry obshchey fiziki Kazakhskogo universiteta (Problem Laboratory of the General Physics Faculty of the Kazakh University). There is 1 graph, 1 set of graphs, 1 set of hookups, 1 photograph, and 12 references, of which 2 are American and 10 Soviet.

Card 2/2

VULIS, L. A., KASHKAROV, V. P. (Alma-Ata)

"Boundary Layer of Compressible Gases on the Surface of a Burning Body."

report presented at the First All-Union Congress on Theoretical and Applied Mechanics, Moscow, 27 Jan - 3 Feb 1960.

VULIS, L. A., ISATAEV, S. I., KASHKAROV, V. P. (Alma-Ata)

"The Propagation of Viscous Streams (Jets) On the Surface of Bodies."

report presented at the First All-Union Congress on Theoretical and Applied Mechanics, Moscow, 27 Jan - 3 Feb 1960.

VULIS, L. A., USTIMENKO, B. P., BESPALOVA, V. G. (Alma-Ata)

"Liquid-Flow Analogy in the Treatment of Problems Concerning the Propagation of Turbulent Jets."

report presented at the First All-Union Congress on Theoretical and Applied Mechanics, Moscow, 27 Jan - 3 Feb 1960.

VULIS, L.A., otv. red.; KASHKAROV, V.P., red.; KOSOV, N.D., red.;
PETROVA, N.M., red.; KASHKAROV, L.D., tekhn. red.

[Study of transfer processes. Problems in the theory of relativity] Issledovanie protsessov perenosa. Voprosy teorii otnositel'nosti. Alma-Ata, Uchpedgiz Kazakhskoi SSR. 1960. 161 p. (Its Trudy, no.2) (MIRA 17:3)

1. Alma-Ata. Universitet.

31293
S/124/61/000/010/028/056
D251/D301

11.7700

AUTHOR: Vulis, L.A.

TITLE: On the role of temperature pulsation in turbulent combustion

PERIODICAL: Referativnyy zhurnal. Mekhanika, no. 10, 1961, 83, abstract 10 B594 (V sb. 3-e Vses. soveshchaniye po teorii goreniya, v. 1, M., 1960, 91-99)

TEXT: The influence of pulsations of temperature and the connected pulsations of speed on the process of turbulent combustion is considered. Making use of the theorem of K.I. Shchelkin on surface combustion, the author constructs a model for calculating the time of complete combustion in a turbulent flow of a homogeneous mixture, and obtains the relation of dependence of the time of complete combustion and also (for a known dependence of the time of complete combustion on various factors) the dependence of the dimensions of the zone of complete combustion, the velocity of flame-

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On the role of temperature...

spreading and the evolution of heat on the turbulent pulsations of temperature and velocity. The theoretical dependence is satisfactorily confirmed by known experimental data. 13 references. [Abstracter's note: Complete translation]

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X

VULIS, L.A.

Calculation of turbulent free flow by the use of the equivalent problem of the theory of heat conductivity. Izv. AN Kazakh. SSR. Ser. energ. no.2:60-67 '60. (MIRA 14:3)
(Jets—Fluid dynamics)

ARTYUKH, L.; VULIS, L.A.; USTIMENKO, B.P.

Hydrodynamic theory of heat transfer applied to liquids with small Prandtl numbers. Izv.AN Kazakh. SSR Ser.energ. no.2:76-89 '60. (MIRA 13:7)
(Hydrodynamics) (Heat—Transmission)

25412
S/137/61/000/006/001/092
A006/A101

11.7200

AUTHORS: Vulis, L.A., Kashkarov, V.P.

TITLE: Heat conditions of the boundary layer during heterogeneous combustion

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 6, 1961, 1, abstract 6B1 (V sb. "3-ye Vses. soveshchaniye po teorii goreniya, v. 2, Moscow, 1960, 98 - 106)

TEXT: The authors solved a system of equations for a flat laminar boundary layer of compressible gas, consisting of equations of motion, continuity, energy, diffusion and state. Dependences were obtained which made it possible to find the distribution of velocities, temperature and concentration, and also ignition and extinction conditions in the boundary layer for a plate passed around by a homogeneous flow of viscous gas. An analogous problem for the jet flow around a cone is briefly mentioned. The authors present correlations between two dimensionless parameters, determining the combustion process, for 2 different types of process, i.e. a "hysteresis" and a "non-crisis" process. For the rapid motion

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25743
S/123/61/000/012/036/042
A004/A101

11.7200

AUTHORS: Vulis, L. A.; Yershin, Sh.A.

TITLE: On the aerodynamical theory of the gaseous tongue of flame

PERIODICAL: Referativnyy zhurnal, Mashinostroyeniye, no. 12, 1961, 22, abstract 12I180 (V sb. "3-ye Vses. soveshchaniye po teorii goreniya. v. 2", Moscow, 1960, 219-227)

TEXT: The authors present a brief survey on investigations of the aerodynamical theory of the gaseous tongue of flame based on the idea of an infinite reaction rate of combustion. This assumption leads to a scheme of diffusion combustion as in the case of both unmixed gases and homogeneous mixtures. The latter case is investigated in detail. If for the case of combustion of unmixed gases the equation system is complete, since the flame front is found from the stoichiometric relation of the flows of the reacting components, an additional assumption on the position of the flame front is necessary for the flame tongue of a homogeneous mixture. In order to solve this problem, the condition of the gas-dynamic scheme of the flame front is taken as an oblique heat discontinuity. In such a scheme the whole range of flame tongue is replaced by the surface of

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discontinuity in the velocity, temperature, mixture composition, ect. Equations of continuity, momentum and energy are written down, and the dependence is derived of the gas-dynamic parameters on angle α_1 - the slope of the flame front relative to the normal to the lines of the flow up to the discontinuity. It is assumed that the solution sought for is taking place at the maximum deviation angle of the lines of the flow in the discontinuity. At a given heat release characteristic (ratio of the thermal effect to the initial enthalpy) of the order 5-7 the magnitude of α_1 is near to 70°. In this case the angle of slope of the flame front does not depend on the flow velocity and only slightly depends on the heat release characteristic. A comparison of these results with the test data shows that actually, as this follows also from the "aerodynamical scheme", a certain warming-up of the fresh mixture, its expansion and a deviation of the lines of the flow to the flame front, can be always observed. Owing to this a value α_1 = 83 is obtained at the burner with an ordinary flame front, while with an inverted flame (behind the stabilizer) value $\alpha_1 = 60°$. The authors analyze the problem of an increased flow velocity behind the flame front. Also in this case the conception of an oblique heat discontinuity was used and experimental checks were carried out. From a nozzle 20 mm in diameter across which a stabilizer (1.5 mm diameter wire) was fastened, a jet of gasoline vapors and air

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On the aerodynamical theory ...

mixed beforehand flowed vertically upwards. With the aid of a special feeder fine quartz sand was fed into the flow, which was photographed when streaming out from the nozzle. The particle speed behind the flame front was determined from the length of the trajectory and photographic exposure. It was found that during the passing of the flame front the speed increased by a factor of 1.5 which agrees with the theoretical results. There are 4 figures and 23 references.

Sh. M. S.

[Abstracter's note: Complete translation]

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VULIS, L.A.; GRUSHANOV, L., tekhn. red.

[Overlapping of molecular and molar effects in the transition region of a flow; Conference on Heat and Mass Transfer, Minsk, June 5-10, 1961] O vzaimonalozhenii molekuliarnykh i moliarnykh effektorv v perekhodnoi oblasti techeniia; soveshchanie po teplo-i massoobmenu, g. Minsk, 5-10 iiunia 1961 g. Minsk, 1961. 16 p. (MIRA 15:2)

(Hydrodynamics) (Heat—Transmission) (Mass transfer)

VULIS, L. A., KOSHKAREV, B. P., YARIN, L. P., and ARIYUKH, L. Y.

"Thermal Problems of a Boundary Layer at Heterogenous and Diffusive Combustions."

Report submitted for the Conference on Heat and Mass Transfer, Minsk, BSSR, June 1961.

VULIS, L. A., LEONT'YEVA, T. P., PALATNIK, I. B., SAKINOV, Z. B., AND USTIMENKO, B. P.

"Thermal Problems of a Free (stream) Turbulent Boundary Layer."

Report submitted for the Conference on Heat and Mass Transfer, Minsk, BSSR, June 1961.

VULIS, L. A., ZHEREBYAT'EV, I. F. and LUK'YANOV, A. T.

"Solution of Non-linear Equations of Thermal Conductivity by Static Electrical Integrators."

Report submitted for the Conference on Heat and Mass Transfer, Minsk, BSSR, June 1961.

VULIS, L. A.

"On Superposition of Molecular and Molar Effects in the Transient Region of a Flow."

Report submitted for the Conference on Heat and Mass Transfer, Minsk, BSSR, June 1961.

87758

S/096/61/000/002/011/014
24.5200 (1191, 1498, 1537) E194/E155

AUTHORS: Vulis, L.A., Doctor of Technical Sciences,
Gurvich, A.M., Doctor of Technical Sciences, and
Klinger, V.G., Candidate of Technical Sciences

TITLE: Optical Modelling of Radiant Heat Exchange in Furnaces

PERIODICAL: Teploenergetika, 1961, No.2, pp. 67-71

TEXT: The general theory of similarity requires than an optical model should fulfil the three conditions: geometrical similarity; identity of optical properties of surfaces and media; and similarity in the distribution of radiation sources. A special feature of the optical modelling method developed in the Kazakh University is that it avoids fulfilling the third condition by determining on the model a system of optical-geometrical parameters. When these are known it is possible to calculate the distribution of radiant fluxes with an arbitrary distribution of sources in the system in which only the first two conditions need be observed. Thus the technique of optical modelling is greatly simplified. The object of the present article is to direct attention to this method which is still not sufficiently widely used. Accordingly,
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Optical Modelling of Radiant Heat Exchange in Furnaces

the essentials of the method are described and practical results are given. In optical modelling of radiant heat exchange the radiant fluxes are so low that the temperature factor does not enter into the experiment. The method is nevertheless applicable to studies of furnaces where heat fluxes and temperatures are high, because the equations of radiant heat exchange are the same whatever the energy or spectral composition of the radial fluxes. The temperature distribution is determined in the model by the self-radiation distribution both in the volume and on the walls. From this the temperature distribution is calculated on the basis of the Stefan-Boltzmann law if an integral radiation is modelled; or by Wien's formula if the nature of radiation is being studied from separate spectral bands. The present article considers only integral radiation and assumes that the radiating walls and media have the properties of grey diffuse radiating and absorbing bodies. In modelling, the object is sub-divided into a number of surface and volume isothermal zones. The optical properties of the surface zones are characterised by the mean absorption capacity and those

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Optical Modelling of Radiant Heat Exchange in Furnaces

of the volumetric zones by the attenuation factor of the medium. Modelling consists in constructing a geometrically similar system of surfaces having optical properties identical with the original and a similar distribution of isothermal zones. The attenuating properties required of the medium are discussed. The method is based on the principle of additivity of radiant fluxes which makes it possible to determine the optical-geometrical parameters of the model. If only one surface zone in the model is radiating, the incident flux on different elements of surface can be measured. These incident fluxes will be both those received by direct but attenuated radiation and those reflected from other surfaces. By successively making one zone luminous after another and measuring the resultant incident fluxes, dimensionless absorption factors may be determined for various elements considered. Then the results are summated to determine the flux density incident on any zone from all the other zones. Simple formulae are derived and it is shown that by tests on a single model and simple calculations it is possible to solve a range of problems. The study of radiant heat

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E194/E155

Optical Modelling of Radiant Heat Exchange in Furnaces

exchange in the chamber of a stoker-fired furnace by optical modelling is then considered. A transparent plastic model in the shape of a cube of side 15 cm inside contained thin metal walls painted matt black. In one of the walls there were 64 holes which were used to measure the incident radiation. Various difficulties that arise in making the measurements are described. Experience has shown that they can be largely overcome if a thin layer of translucent celluloid with a matt surface is placed between the inner wall of the model and the outer. As incident radiation may be at any angle, the sensitivity of the pick-up should not depend on the angle of incidence. This condition is largely satisfied by a germanium photodiode operating as a valve. This photodiode has maximum sensitivity in the infrared where the absorbing capacity of ordinary water is fairly great. Accordingly water may be used as the attenuating medium in the model. The problem of modelling self-radiation of the medium filling the volume is overcome by having a single source of radiation, moving it from place to place and summating the results. The particular model described was divided

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Optical Modelling of Radiant Heat Exchange in Furnaces

into 64 zones. The radiating element was a cube of transparent plastic, corresponding accurately to the size of the zone. The cube contained a small lamp; it was filled with water and the outside was covered with translucent celluloid. To check the experimental procedure a model was used to study the radiant output of a cylindrical source for which a method of calculation exists. The calculated and experimental results agreed within 5% and the accuracy could easily be increased to 2-3%. The burning layer of fuel was represented by a flat illuminator with uniformly luminous matt surface. The measurements were made and for each unit of sub-division a table of 64 local values of absorption factor was drawn up. There was no need to make 64 such tables; because of the symmetry of the model only 16 were required. The tables were then used to calculate absorption factors from formulae (3) and the distribution of incident fluxes on the walls of the model was determined for the case of a uniformly radiant medium and a fuel layer. Examples of radiant flux distribution of the model were plotted. Attention has recently been drawn to radiation

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Optical Modelling of Radiant Heat Exchange in Furnaces

back from the screen tubes. Accordingly the difference between the actual operating conditions of screens and those which are usually assumed was investigated. A study was made of the influence of the degree of blackness of the screen tubes on the heat exchange conditions in furnaces. The method of setting up the model to do this is briefly described and comparative data for tubes with absorption factors of 0.6 and 0.9 shows that alteration of the degree of blackness of the screen tubes has no important influence on the radiant heat exchange in the case considered. Results obtained in tests on the optical model with almost black surface were compared with calculated values for absolutely black tubes and agreement was good. Ways in which the procedure may be further developed are discussed and it is recommended as a useful aid in calculations of heat exchange.
There are 3 figures, 1 table and 11 references: 7 Soviet and 4 English.

ASSOCIATION: Kazakhskiy universitet i TsKTI (Kazakh University and Central Boiler Turbine Institute)

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11.7200

S/170/61/004/003/003/013
B117/B209

AUTHORS: Artyukh, L. Yu., Vulis, L. A., Kashkarov, V. P.

TITLE: Flow of gas around a plate with burning surface

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, v. 4, no. 3, 1961, 39-45

TEXT: The authors investigated the flow of a homogeneous compressed gas around a burning plate. The variation in velocity, temperature, and concentration profiles along the plate was considered in the approximation obtained. The studies were devoted mainly to laminar flow in the boundary layer along the plate. In order to find the "quasi-progressing" profiles u, T, and c, solutions of transcendental equations of the heat theory of combustion are used, which are reduced to the boundary conditions on the surface of reaction. For this purpose, the boundary conditions of the surface of the plate are transformed into the form usually employed in problems of the thermal conditions of combustion. The transcendental equation (8) from Ref. 6 (Vulis, L. A. Teplovoy rezhim goreniya, GEI, M. -L., 1954) $\phi = \tau/[\tau + \exp(1/\theta_w) = (1/\mathfrak{A})[\theta_w - \chi\theta_\infty + \beta\tau(\theta_w - \theta_{0\,\infty})]$ was graphically solved X

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Flow of gas around ... S/170/61/004/003/003/013
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in a $\phi - \theta_w$ plane. Figs. 1 and 2 illustrate typical results of these solutions. The schematic representation of the graphically determined results (Fig. 1) gives a clear picture of the dependence of the surface temperature on the velocity of the incoming flow, when the parameters of heat exchange β and of the length x are given and various values of heat generation $\vartheta_4 > \vartheta_3 > \vartheta_2 > \vartheta_1 = 0$ are assumed (B - point of ignition, П-point of extinction, A and T - adiabatic and heat exchange, respectively). When the values of heat generation are given for two velocities of the incoming flow, the temperature variation along the burning plate shows (Fig. 2) that ignition of the plate takes place, if any at a certain distance from the front edge of the plate. The values of temperature θ_w and of concentration c_w determined by a graphical solution of Eq. (8) according to the coordinate $\bar{x}$, make it possible to construct the profiles of u, T, and c in the cross sections of the flow if all the other parameters are given. Fig. 3 shows the profiles for two cross sections (before and after ignition) as an example of such a construction. It was further shown that the state before ignition belongs to a kinetic combustion according to the nature of the process, and after ignition to the diffusion zone. This result is typical of a hysteretic

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Flow of gas around ...

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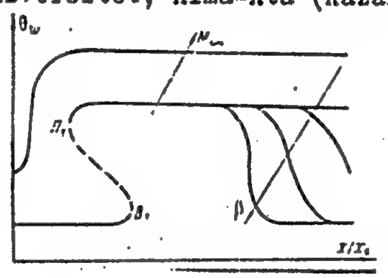
process of an exothermic heterogeneous reaction if combustion takes place only in the vicinity of the diffusion zone. The authors point out that, in principle the obtained solution may be generalized to the case of a burning plate with a turbulent boundary layer. More details about this case will be published in a special paper. From the practical standpoint, the present problem has to be treated as one of the limiting schemes of ignition and burning of bodies which move at high speed through the atmosphere. Mention is made of Dorodnitsyn, Ya. B. Zel'dovich. There are 3 figures and 7 references: 6 Soviet-bloc.

ASSOCIATION: Kazakhskiy gosudarstvennyy universitet, Alma-Ata (Kazakh State University, Alma-Ata)

SUBMITTED: June 21, 1960



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27242
S/170/61/004/009/001/013
B104/B125

11.7430

AUTHORS: Vulis, L. A., Palatnik, I. B.

TITLE: Mechanism of turbulent mixing in gas flows

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, v. 4, no. 9, 1961, 5-11

TEXT: The experimental arrangement shown in Fig. 1 was used to study the turbulent mixing of a gas jet with a gas flow of different temperature. The limits within which the parameters of gas jet and gas flow were varied, are listed in Table 1. In their experiments, the authors determined the velocity head and the temperature distribution along the axis and over the cross section. The velocity head was measured with a Pitot tube 0.8 mm in diameter, and the temperature was determined by means of a platinum - platinum rhodium thermocouple. The turbulence of the gas jet and of the gas flow at the exit section of the nozzle was measured by means of an ЭТАМ-3А (ETAM-3A) electrothermoanemometer. The flow velocities were computed from measurements of ϱu^2 and ΔT. As characteristics for the intensity of turbulent mixing at a given point of the flow, the following relations were used $\varepsilon = 1 - (\varrho u^2)_m/(\varrho u^2)_0$ and

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Mechanism of turbulent mixing ...

$\varepsilon_T = 1 - (T_m - T_n)/(T_o - T_n)$, where the subscript m refers to the axis of the jet. These characteristics tend toward zero in the absence of mixing and toward unity with complete mixing. The authors determined the function $\varepsilon_T = f(m)$, where $(m^2 = (\varrho u^2)_o)$; it may be seen from this function that at any given distance from the mouth of the nozzle, the quantity $1 - \varepsilon_T$ and consequently, the conditions for a minimum mixing of the jet with the flow practically coincide at $m = 1$. In this case, jet and flow have the same velocity. The decisive role played by the density of the pulse flow in turbulent mixing may be seen from the function $\varepsilon_T = f(m)$. Measurements were then obtained at one and the same point on the axis of the jet ($x/d_o = 5$; x is the distance from the mouthpiece of the nozzle, and d_o is its diameter) at different temperatures. The relative disposition of the curves $\varepsilon_T = f(m)$ indicates that the damping rate of the jet varies with increasing temperature. The decrease of the quantity $\Delta T_m/\Delta T_o$ and also of u_m/u_o with $\omega = T_o/T_n > 1$ is greater than with $\omega \approx 1$. On the basis of the "similarity of ϱu^2" it is shown that a universal dependence of $(\varrho u^2)_m/(\varrho u^2)_o$

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on x/d_o on the axis of the jet is confirmed by the results of measurement. Moreover, it was found that the quantity $(\varrho u_m^2/\varrho u_o^2)$ drops the more, the higher is the temperature of the gas jet. The mixing process accelerates slowly and continuously with ω. With slight heating the level of pressure pulses rose from 1-2% at ω = 1 to 10-12% at ω = 3; with intense heating, values of 3-4 and 12-15% were obtained at the analogous values of ω. G. N. Abramovich is mentioned. There are 4 figures, 1 table, and 7 Soviet references.

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ASSOCIATION: Institut energetiki AN KazSSR, g. Alma-Ata (Institute of Power Engineering AS Kazakhskaya SSR, Alma-Ata)

SUBMITTED: June 21, 1960

Fig. 1: Schematic representation of the experimental arrangement. Legend: (1) Outer tube; (2) inner tube; (3) nozzle for the central gas jet (diameter, 10 mm); (4) nozzle for the outer gas flow (diameter, 250 mm); (5) air intake for the inner tube; (6) centrifugal ventilator for the outer

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S/057/61/031/007/008/021
B111/B206

3.2600

AUTHORS: Vulis, L. A. and Gusika, P. L.

TITLE: The "reversal" of effects in magnetohydrodynamics

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 7, 1961, 806-818

TEXT: The application of the "law of the reversal of effects" on steady quasi-unidimensional flows of a conductive gas which is affected by hydro- and electrodynamic factors, is discussed. This law was formulated by L. A. Vulis (Ref. 1: DAN SSSR, 54, 669, 1946; 56, 799, 1947) in the general for the unidimensional steady motion of a gas, and has the form

$$(M^2 - 1)\frac{d\ln z}{dx} = \sum_i \alpha_i^2 \frac{dw_i}{dx} \frac{d\Omega}{dx} \qquad (1)$$

where M is the Mach number, z the symbol for the rate of flow u, the mach number or a state parameter of the gas, x the direction of u, dw_i/dx the "effect", and $d\Omega/dx$ the sum of effects. By the "effects" dw_i/dx the authors mean cross sectional changes of the channel, changes of the outflow rate, or supply and removal of energy in the form of work, heat, and friction. Of special interest in magneto-

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hydrodynamics is the effect of the electromagnetic field on the flow of the conductive gas. This effect is studied in two aspects. 1) The passage through the critical rate of propagation of disturbances in any dense moving medium is investigated by means of (1). 2) The dependence of the electric volume force (and dissipation) on the rate of flow is investigated. The passage through sound velocity and the application of the "Law of the reversal of effects" in magnetohydrodynamics was explained by G. S. Golitsyn and K. P. Stanyukovich (ZhETF, 33, 6 (12), 1417, 1957) for finite, but large electric conductivity, i.e., great Re_m. The same study was conducted by E. L. Reslera and W.R. Sears (ZAMP, 96, no. 5/6, 509, 1958; J. Aeron. Sci., 25, no. 4, 235, 1958) for small Re_m values. From the magnetohydrodynamic fundamental equations, the authors derive equation

$$(M^2-1)\frac{d\ln u}{dx}=\frac{d\ln F}{dx}+\frac{1}{a^2}\frac{dp}{dx}+\frac{1}{\rho a^2}[\mathbf{j}\mu\mathbf{H}]_x-$$
$$-\frac{1}{a^2}\left(\frac{d\mathcal{L}}{dx}+\frac{d\mathcal{L}_{\text{тр.}}}{dx}\right)+\frac{1}{\rho c_p}\left(\frac{\partial\rho}{\partial T}\right)_p\left(\frac{dQ}{dx}+\frac{dQ_{\text{тр.}}}{dx}+\frac{j^2}{\rho u\sigma}\right). \quad (8)$$

for the reversal of effects, where F is the channel cross section, φ the gravitational potential, L_{Tp} and Q_{Tp} the frictional energy and -heat, L the mechanical energy, Q the heat from other heat sources. In the next two paragraphs, first the electromagnetic effect and then the passage through the hydrodynamic sound velocity are isolated and studied in detail. For the general case of the passage through the total magnetohydrodynamic sound velocity,

$$(\tilde{M}^2-1)\frac{d\ln u}{dx}=\frac{1}{1+\xi A^2}\left[\frac{d\ln F}{dx}-\frac{\gamma-1}{a^2}\left(\frac{dQ}{dx}+\frac{j^2}{\rho u\sigma}\right)\right]. \qquad (18)$$

holds for the "law of the reversal of effects", where $\tilde{M}^2 = M^2/(1+\xi A^2)$, $\tilde{M}^2 = 1 + A^2$, and for ξ holds $\xi = 1/(1 - H''/Re_m \cdot H')$ (20), $0 < \xi < 1$. The primed quantities in (20) signify the derivation according to $\bar{x} = x/l$. A special case of this problem was dealt with by L. A. Vulis and K. P. Stanyukovich (Ref. 8: V sb. "Issledovaniye protsessov perenosa. Voprosy teorii otnositel'nosti" - ("Investigation of transfer processes, Problems of relativity theory"), vyp. 2. Trudy KazGU, Uchpedgiz, Alma-Ata,

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The "reversal" of effects in ... S/057/61/031/007/008/021
B111/B206

1960) and K. P. Stanyukovich (Ref. 9: Neustanovivshiyesya dvizheniye sploshnoy sredy, GITTL, M., 1955) during the study of the gas loss of stars. The studies conducted by the authors showed that the "law of the reversal of effects" on quasi-unidimensional steady flows of a conductive gas can be applied for electromagnetic effects. In the general case, the reversal of the effects leads to a generalization of the mach number $M = u/\tilde{a}$, where $\tilde{a}$ is the total sound velocity in magnetohydrodynamics; for $Re_m > 1$, $\tilde{a} \approx \sqrt{a^2 + v_A^2}$ holds and for $Re_m < 1$, $\tilde{a} \approx a$, so that in general $\tilde{a}^2$ becomes $\sqrt{a^2 + \xi v_A^2}$, where ξ is determined from (20). N. Ye. Zhukovskiy is mentioned. There are 3 figures, 2 tables, and 13 references: 10 Soviet-bloc and 3 non-Soviet-bloc.

ASSOCIATION: Kazakhskiy gosudarstvennyy universitet im. S. M. Kirova, Alma Ata (Kazakh State University im. S. M. Kirov, Alma-Ata)

SUBMITTED: July 25, 1960

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26.2311

S/057/61/031/007/009/021
B104/B206

AUTHORS: Vulis, L. A. and Gusika, P. L.

TITLE: Hydro-gas-analogy in magnetohydrodynamics

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 7, 1961, 819-823

TEXT: N. Ye. Zhukovskiy (Trudy TsAGI, no. 1, 1925) showed that the motion of an incompressible fluid in a closed channel is in many respects analogous to the isentropic motion of a compressible gas. It can be easily shown that this analogy is also kept up for the motion of conductive media during the effect of electromagnetic forces. The equations of motion for a plane isentropic flow of a compressible conductive gas, and those for a quasi-plane motion of a conductive liquid in closed channels are investigated. In the first part, the system

$$\frac{\partial \rho}{\partial t} + \frac{\partial (\rho u)}{\partial x} + \frac{\partial (\rho v)}{\partial y} = 0, \qquad (1)$$

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$$\left.\begin{aligned}\rho\frac{\partial u}{\partial t}+\rho u\frac{\partial u}{\partial x}+\rho v\frac{\partial u}{\partial y}&=-\frac{\partial p}{\partial x}+\left[\mathbf{j}\mu\mathbf{H}\right]_x+f_x,\\ \rho\frac{\partial v}{\partial t}+\rho u\frac{\partial v}{\partial x}+\rho v\frac{\partial v}{\partial y}&=-\frac{\partial p}{\partial y}+\left[\mathbf{j}\mu\mathbf{H}\right]_y+f_y,\end{aligned}\right\} \quad (2)$$

$$c_pT+\frac{V^2}{2}=c_pT_0. \quad (3)$$

is written down for the gas flow and in the second part, the system

$$\frac{\partial \bar{h}}{\partial t}+\frac{\partial(\bar{h}u)}{\partial x}+\frac{\partial(\bar{h}v)}{\partial y}=0, \quad (7)$$

$$\left.\begin{aligned}\bar{h}\frac{\partial u}{\partial t}+\bar{h}u\frac{\partial u}{\partial x}+\bar{h}v\frac{\partial u}{\partial y}&=-g\bar{h}\frac{\partial h}{\partial x}+[\mathbf{j}\mu\mathbf{H}]_x+f_x,\\ \bar{h}\frac{\partial v}{\partial t}+\bar{h}u\frac{\partial v}{\partial x}+\bar{h}v\frac{\partial v}{\partial y}&=-g\bar{h}\frac{\partial h}{\partial y}+[\mathbf{j}\mu\mathbf{H}]_y+f_y,\end{aligned}\right\} \quad (8)$$

$$h + \frac{V^2}{2g} = h_0. \qquad (9)$$

for a fluid flow with free surface. In both cases $[\vec{j}\mu\vec{H}]$ was considered, and from a comparison of the two systems it may be seen that they are analogous for $\gamma = 2$. The following analogues are compared: Mach number $M = V/a$ - Froude number $Fr = V/c$; density ratio ϱ/ϱ_0 - height ratio h/h_0; pressure ratio p/p_0 - ratio of the squares of the heights h^2/h_0^2; temperature ratio T/T_0 - height ratio $h:h_0$; Alfvèn number $A = V_A/a$ - analogue of the Alfvèn number $\bar{A} = \bar{V}_A/c$. In the last ratio, $V_A = \sqrt{\mu H/\varrho}$ denotes the velocity of the magnetoacoustic oscillations in a medium with infinite conductivity. These ratios form the basis for simulating flows of a conductive gas by means of the flows of a conductive liquid in a trough on application of electric and magnetic fields. For both cases the known relations $\vec{j} = \mathrm{curl}\,\vec{H}$ and $\vec{j} = \sigma(\vec{E} + [\vec{V}\mu\vec{H}])$ hold for the flow density vector and $\partial\vec{H}/\partial t = \mathrm{curl}[\vec{V}\vec{H}] + \nu_m \nabla^2\vec{H}$ for the correlation between magnetic field strength

and flow velocity. The completion of the initial equations by these two differential equations determines the conditions for electromagnetic simulating. The main criterium for both flows is the magnetic Reynolds number $Re_m = Vl/\nu_m$, where $\nu_m = 1/\mu\sigma$ is the so-called magnetic viscosity and σ the conductivity. As is shown, the analogy investigated here permits the variation of Re_m in a very wide range. For $Re_m \ll 1$, aerodynamic problems may be investigated, for $Re_m \longrightarrow \infty$, problems of astrophysics. The authors investigate the fluid flow in an open channel with slowly changing width. Then, the continuity equation and the equation of motion are:

$$\frac{d\ln h}{dx} + \frac{d\ln u}{dx} + \frac{d\ln b}{dx} = 0, \qquad (14)$$

$$\bar{h}u\frac{du}{dx} = -g\bar{h}\frac{dh}{dx} + [\mathbf{j}\mu\mathbf{H}]_x, \qquad (15)$$

$b = b(x)$ being the channel width. By means of the Froude number $Fr = u/\sqrt{gh}$,

$$(Fr^2 - 1)\frac{d\ln u}{dx} = \frac{d\ln b}{dx} - \frac{1}{h c^2}[j_1 H], \tag{16}$$

is obtained for the flow velocity and

$$(Fr^2 - 1)\frac{d\ln Fr^2}{dx} = 2\left(1 + \frac{Fr^2}{2}\right)\frac{d\ln b}{dx} - \frac{3}{h c^3}[j_1 H], \tag{17}$$

for the Froude number itself. These equations are analogous to those in ordinary gas dynamics and in magnetogasdynamics. They are discussed for $Re_m \ll 1$ and $Re_m \gg 1$. There are 6 references: 5 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Kazakhskiy gosudarstvennyy universitet im. S. M. Kirova Alma-Ata (Kazakh State University imeni S. M. Kirov, Alma-Ata)

Card 5/6

10.3100

11.6200

31724
S/057/61/031/012/011/013
B104/B112

AUTHORS: Vulis, L. A., and Kashkarov, V. P.

TITLE: The local redistribution of the total energy in the boundary layer of a compressible gas on the surface of a burning body

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 12, 1961, 1477-1484

TEXT: A study has been made of the local redistribution of the total energy (total of kinetic energy plus physical and chemical enthalpy) in the boundary layer of a compressible gas which passes around the surface of a plat of a plate in a laminar flow and reacts with it by an infinitely fast heterogeneous reaction. The system of equations

$$\left.\begin{aligned} u\frac{\partial u}{\partial \xi}+\tilde{v}\frac{\partial u}{\partial \eta} &= \nu_\infty\frac{\partial^2 u}{\partial \eta^2}, \\ \frac{\partial u}{\partial \xi}+\frac{\partial \tilde{v}}{\partial \eta} &= 0, \\ u\frac{\partial T}{\partial \xi}+\tilde{v}\frac{\partial T}{\partial \eta} &= a_\infty\frac{\partial^2 T}{\partial \eta^2}+\frac{\nu_\infty}{C_p}\left(\frac{\partial u}{\partial \eta}\right)^2, \\ u\frac{\partial C}{\partial \xi}+\tilde{v}\frac{\partial C}{\partial \eta} &= D_\infty\frac{\partial^2 C}{\partial \eta^2}. \end{aligned}\right\} \quad (1),$$

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The local redistribution of...

derived by Ye. P. Vaulin (DAN SSSR, 113, 6, 1957) is started from. For the boundary conditions

$$\left.\begin{array}{c} u=v=0,\ \lambda_w \frac{\partial T}{\partial \eta}\Big|_w + q\rho_w D_w \frac{\partial C}{\partial \eta}\Big|_w = 0,\ C=0 \text{ при } \eta=0, \\ u=u_\infty,\ T=T_\infty,\ C=C_\infty \text{ при } \eta\to\infty \end{array}\right\} \quad (2),$$

this system may be transformed into a system of ordinary differential equations

$$\left.\begin{array}{c} 2F''' + FF'' = 0, \\ 2T'' + \sigma FT' = -2\sigma \frac{U_\infty^2}{C_p} (F'')^2, \\ 2C'' + \sigma_D FC' = 0 \end{array}\right\} \quad (3)$$

by the substitution $u = u_\infty F'(\varphi)$, $T = T(\varphi)$, $C = C(\varphi)$, where $\varphi = \sqrt{U_\infty/\nu_\infty \xi}$; u and v are the components of the velocity vector; $v = \frac{\varrho}{\varrho_\infty} v + u\frac{\partial \eta}{\partial x}$, $\xi = x$, $\eta = \int_0^y \frac{\varrho}{\varrho_\infty} dy$ are the Dorodnitsyn variables, T and C

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are temperature and concentration, ϱ the gas density, q the heat of reaction, λ the thermal conductivity of the gas, σ and σ_D are Prandtl's heat and diffusion numbers, and C_p is the specific heat of the gas. As solutions of this diffusion and heat-conduction problem, the profiles of velocity, temperature, and concentration of the reacting gas are plotted for different Prandtl numbers. B. A. Fomenko of the Laboratory for Problems of Thermal Physics of Kazakh State University is thanked for numerical calculations and plots. Ya. B. Zel'dovich (Teoriya goreniya i detonatsiya gazov. Izd. AN SSSR, M., 1944) is mentioned. There are 9 figures and 10 references: 8 Soviet and 2 non-Soviet.

ASSOCIATION: Kazakhskiy gosudarstvennyy universitet im. S. M. Kirova (Kazakh State University imeni S. M. Kirov)

SUBMITTED: October 17, 1960

35474

S/089/62/012/004/002/014
B102/B104

21.1000

AUTHORS: Vulis, L. A., Kostritsa, A. A., Kubyshkina, V. D.

TITLE: Calculation and simulation of optimal reactors with homogenized core (age approximation)

PERIODICAL: Atomnaya energiya, v. 12, no. 4, 1962, 283-291

TEXT: The authors discuss some methods for calculating homogenized-core reactors with minimum critical mass and constant density of released energy due to absorber redistribution in the core. By using the integrators described in earlier papers (Vulis, Kostritsa, Tr. KazGU, Alma-Ata, 1959; Izv. AN KazSSR, ser. energet. no. 14, 111, 1959; Vestnik AN KazSSR, no. 9, 1959), some characteristic functions such as the fuel density distribution and the neutron density distribution are determined. The equations for a reactor with nonuniformly distributed fuel are difficult to solve in age or multigroup approximation but easy by simulation methods. A one-dimensional static integrator designed for solving heat-conduction-type equations with constant factors is described and discussed. In principle, reactor simulation needs two integrators: the first one for neutron moderation whose results

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are fed into the second one which simulates thermal-neutron diffusion. For determining the minimum critical fuel mass, the function

$$\psi(x) = -1 + \frac{\eta}{\sqrt{4\pi\tau}} \int_{-1}^{+1} \psi(\alpha) e^{-\frac{(x-\alpha)^2}{4\tau}} d\alpha. \qquad (11)$$

is used; in this case, the moderator density $n_{\tau=\tau_t} \sim n_{\tau=0} \sim \psi(x)$; $\psi = (T_0 - T)/T$, $k = \eta\psi/(\psi+1)$; T_0 is the life-time of thermal neutrons in the reflector, η is the mean number of seondary neutrons per thermal neutron absorbed by the fuel; $\sqrt{\tau}$ is the moderation length, τ_t the thermal neutron age; all the parameters of the dimension of a length are taken as dimensionless. Calculations of the critical fuel mass $\int \psi dx$ in age and two-group approximations are compared (Table 1). For thermal-neutron density smoothing by an additional absorber,

$$\frac{T}{T_0} = \frac{1}{1 + \frac{\Sigma_{ar}}{\Sigma_{a3}} + \frac{\Sigma'(r)}{\Sigma_{a3}}} = \frac{1}{1 + \psi + \nu(r)}, \qquad (12)$$

is used, where the sought function $y(\vec{r}) = \Sigma'(r)/\Sigma_{a3}$ is proportional to the density of the additional absorber whose absorption cross section is $\Sigma'(r)$. $\frac{\Sigma_{ar}}{\Sigma_{a3}} = \psi$, the macroscopic absorption cross section ratio of fuel and moderator. In two-group approximation $f(y) = \frac{2}{\eta}\left[y(\vec{r}) + \frac{\psi+1}{\psi}\right]$; the analytic form of f(y) and the criticality conditions are calculated in age and two-group approximations for a plane, a cylindrical, and a spherical reactor. From a comparison of the results it may be seen that the age approximation is well usable, and that neutron density smoothing problems lead to heat-conduction-type equations solvable by static integrators. There are 5 figures, 2 tables, and 15 references: 7 Soviet and 8 non-Soviet. The four most recent references to English-language publications read as follows: G. Goertzel. J. Nucl. Energy, 2, No. 3, 193, 1956; J. Wilkins. Nucl. Sci. Engng, 6, No. 3, 229, 1959; J. Ravets, J. Lamarsh. Nucl. Sci. Engng, 7, No. 6, 496, 1960; M. Duret, W. Henderson. Nucleonics, 16, No. 11, 168, 1958.

Card 3/4

42745
S/124/62/000/011/011/017
D234/D308

10.1200 11.7200

AUTHOR: Vulis, L. A.

TITLE: An interpolation formula for transition region of flow

PERIODICAL: Referativnyy zhurnal, Mekhanika, no. 11, 1962, 90, abstract 11B639 (Tr. In-ta energ. AN KazSSR, 1961, v. 3, 109-121)

TEXT: The author introduces a 'measure of disorder' $\omega(\varkappa)$ of the state of transition between laminar and turbulent flow conditions

$$\omega(\varkappa) = \frac{L_2(\varkappa) - L(\varkappa)}{L_2(\varkappa) - L_1(\varkappa)}, \quad \varkappa = R - R_{cr.1}, \quad \omega(0) = 1 \qquad (1)$$

where $L(\varkappa)$ is an integral (resistance, heat loss) or local (velocity profile, temperature profile, intensity of turbulent pulsation) characteristic of flow, $\varkappa$ is the coordinate of state (diffe-

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rence between Reynolds' number R and its lower critical value $R_{cr.1}$ at which the laminar flow loses its stability, L_1 corresponds to laminar and L_2 to turbulent conditions. By analogy with relaxation processes it is assumed that

$$\omega(\varkappa) = e^{-\alpha^2} \qquad (2)$$

where α^2 is an empirical constant. From (1) and (2) an interpolation formula

$$L(\varkappa) = L_1(\varkappa) + \left[L_2(\varkappa) - L_1(\varkappa)\right](1 - e^{-\alpha^2\varkappa}) \qquad (3)$$

follows for the conditions of transition. Flow characteristics calculated from this formula are compared with experimental data (and

An interpolation formula ... S/124/62/000/011/011/017
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the constants α^2 are determined). It is proposed to interpret ω as the probability of the viscous conditions predominating over the pulsation conditions (relative gap between pulsations). 8 referneces. /Abstracter's note: Complete translation./

Card 3/3

VULIS, L.A.; KASHKAROV, V.P.

Local redistribution of the total energy in the boundary layer of a compressible gas near the surface of a burning body. Zhur. tekh. fiz. 31 no.12:1477-1484 D '61. (MIRA 15:1)

1. Kazakhskiy gosudarstvennyy universitet imeni S.M.Kirova.
(Boundary layer) (Gas flow)

VULIS, L.A.

One of the interpolation formulas for the transition flow region. Trudy Inst.energ.AN Kazakh.SSR 3:109-121 '61. (MIRA 14:12)
(Fluid dynamics)
(Heat—Transmission)

VULIS, L.A.

Principal results of the studies of the aerodynamics of the combustion chambers and furnaces. Trudy Inst. energ. AN Kazakh. SSR 2:225-233 '60. (MIRA 15:1)

(Fluid dynamics) (Furnaces)

40956

S/262/62/000/011/010/030
I007/I252

AUTHOR: Vulis, L. A.

TITLE: On the turbulent wake behind a body

PERIODICAL: Referativnyy zhurnal, otdel'nyy vypusk. 42. Silovyye ustanovki, no. 11. 1962, 34-35 abstract 42.11.159. (Tr. Kazakhsk. un-ta), no. 2, 1960, 33-40

TEXT: An approximate picture of the flow in a turbulent wake behind a body is obtained by superposition of a forward homogeneous flow over that generated by a turbulent stream. The solution is based on the fact that at Reynolds numbers of about 10^4 the average motion at a certain distance from, or close to, a body becomes stabilized and regular. An infinitesimal stream inducing the final pulse is assumed to exist at a certain point. The rates throughout the field of flow are determined, on the basis of these assumptions, within the framework of the boundary-layer theory. In order to determine the flow pattern in a wake behind a bluff body its resistance is assumed to be concentrated at a single point, its center, constituting the point-source of the pulse wake. At first approximation, the velocity profile of a complex flow can be constructed by geometrical summation of those of the stream and the uniform flow. Calculations have shown that at $Re = 10^4$-10^5, the zone of reversed flow behind the bodies is: 1.3 diameters for a cylinder, 2 widths for a plate; 1.2 diameters for a sphere and 1.9 diameters for a disk. There are 8 references

[Abstracter's note: Complete translation.]

Card 1/1

40955

11.7200

S/262/62/000/011/009/030
1007/1252

AUTHORS: Vulis, L. A. and Kashkarov, V. P.

TITLE: Boundary layer on a burning cone

PERIODICAL: Referativnyy zhurnal, otdel'nyy vypusk. 42. Silovyye ustanovki, no. 11, 1962, 34, abstract 42.11.158. (Tr. Kazakhsk. un-ta), no. 2, 1960, 19-24

TEXT: Investigations were carried out on the laminar flow of a compressible gas stream emerging from a nozzle mounted at the apex of a right cone and forming a jet spreading along the cone surface. The reactions taking place are assumed to be of endothermic character. For calculation of the velocity profile, temperature and concentration of the reacting gas, the motion in the boundary layer is assumed to be a flow in a semi-confined source-jet, the cone surface to be non-conducting, and its reactivity—to vary with the distance from the apex. The system of differential equations thus obtained is integrated by means of Doronitsyn variables. Solution of this problem permitted determination of the relationship between the hydrodynamics of a compressible gas stream and the combustion theory; results give a qualitative picture of the interaction of a burning gas and the surface of a body. There are 7 references.

[Abstracter's note: Complete translation.]

Card 1/1

S/263/62/000/006/013/015
I008/I208

AUTHORS: Vulis, L.A. and Klinger, V.G.

TITLE: A method of light integration

PERIODICAL: Referativnyy zhurnal, otdel'nyy vypusk. 32. Izmeritel'naya tekhnika, no.6, 1962, 51, abstract 32.6.324. (Tr. Kazakhsk.un-ta, 1960, no.2, 103-108)

TEXT: The possibility of calculating the irradiation of targets, of the radiation of sources if self-absorption is taken into account, and of the radiation barrier, etc., by means of an experimental study of radiation rays on an optical model (the latter serves as a light integrator), is discussed. The simplicity and the sufficient accuracy of the method are illustrated by means of an example, in which the radiation dose received by a disk-like target from a source of particles of the same shape is determined.

[Abstracter's note: Complete translation.]

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D234/D308

11.7000

AUTHORS: Vulis, L. A. and Kashkarov, V. P.

TITLE: Heat regime of the boundary layer in heterogeneous burning

PERIODICAL: Referativnyy zhurnal, Mekhanika, no. 10, 1962, 91, abstract 10B563 (In collection: 3-ye Vses. soveshchaniye po teorii goreniya, v. 2, M., 1960, 98-106)

TEXT: The authors consider a laminar boundary layer on a plate with chemical reaction. The following assumptions are made: The mixture is binary, the viscosity coefficient is proportional to the temperature and is independent of the concentration of the mixture components, the specific heats of the components are equal and constant, the thermal and diffusional Prandtl numbers are constant, the velocity of reaction at the surface is $V = k_0 \exp(-E/RT)C$, where C is the concentration of the reacting gas, the coefficient k_0 is a function of the length of the plate, and the

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form of this dependence is chosen in such a way that the problem becomes self-modelling. Analytical solution of the equations of the boundary layer is obtained and the conditions of ignition and extinction are derived from it. The authors also obtain the dependence of the regime of burning ('hysteresis' or 'noncritical' regime) on dimensionless parameters which determine the process. [Abstracter's note: Complete translation.]

VULIS, L.A.

Applying the semiconductor resistances method for the modeling of thermal conditions in combustion. Izv. AN Kazakh.SSR. Ser. energ. no.1:18-22 '60. (MIRA 15:5)
(Combustion--Electromechanical analogies)

VULIS, L.A.; KOSTRITSA, A.A.; KUBYSHKINA, V.D.

Designing and modeling of optimum homogenized-core reactors (age approximation). Atom. energ. 12 no.4:283-291 Ap '62. (MIRA 15:3)

(Nuclear reactors)

APPROVED FOR RELEASE: 09/01/2001 CIA-RDP86-00513R001961310013-6"

VULIS, L. A.

Research into Applied Mathematics and Mechanics Conducted in the Thermo-Physical Laboratory of KAZAKH State University iemni S. M. KIROV. p. 199

TRANSACTIONS OF THE 2ND REPUBLICAN CONFERENCE ON MATHEMATICS AND MECHANICS (TRUDY VTOROY RESPUBLIKANSKOY KONFERENTSII PO MATEMATIKE I MEKHANIKE), 184 pages, published by the Publishing House of the AS KAZAKH SSR, ALMA-ATA, USSR, 1962

VULIS, L.A., doktor tekhn.nauk, prof.; KOSTRITSA, A.A., dotsent

Elementary theory of the Ranque effect. Teploenergetika 9 no.10:72-77 O '62. (MIRA 15:9)

1. Kazakhskiy gosudarstvennyy universitet.
(Fluid dynamics)

VULIS, L. A.; SENDERIKHINA, I. L.

Calculation of turbulent friction and heat emission in jets using an equivalent problem of the theory of heat transfer. Izv. AN Kazakh. SSR. Ser. energ. no.2:75-82 '62. (MIRA 16:1)

(Fluid dynamics) (Heat—Transmission)

VULIS, L.A.; YERAKHTIN, B.M.; INYUSHIN, M.V.; LUK'YANOV, A.T.

Calculation of thermal conditions of a concrete dam for the selection of efficient methods of construction work. Inzh.-fiz.zhur. 6 no.10:3-8 O '63. (MIRA 16:11)

1. Kazakhskiy gosudarstvennyy universitet imeni Kirova, Alma-Ata.

L 16731-63 EPA(b)/EPF(c)/EWT(l)/EPF(n)-2/EWP(q)/EWT(m)/BDS AFFTC/ASD/
IJP(C)/SSD Pd-4/Pr-4/Pu-4 WW/JD

S/124/63/000/004/018/064

77

AUTHOR: Vulis, L. A. and Genayeva, L. I.

TITLE: On the calculation of integral regularities in the transitional region of flow

PERIODICAL: Referativnyy zhurnal, Mekhanika, no. 4, 1963, 81, abstract 4B548 (Izv. AN KazSSR. Ser. energ., no. 1(21), 1962, 66-73.)

TEXT: For calculating the coefficients of friction 1 and heat exchange 21 (and other integral characteristics), in the transitional flow region, the author proposes to compute, using certain weighted factors, these coefficients at laminar and turbulent flow conditions. The dependence of the weighted factors on the Reynolds number is given. The results of calculation based on the method offered are compared with experimental results. The tests are tied in with specific cases: air flow around a plate, flow of molten metal in a tube, flow in rough channels. There is satisfactory correlation between the test and the calculation. R. M. Kopyatkevich.

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[Abstracter's note: Complete translation.]

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L 23819-65 EWT(1)/EWP(m)/EPA(sp)-2/EWG(v)/EWA(d)/EPR/EPA(w)-2/T-2/FCS(k)/

ACCESSION NR: [illegible] S/0057/64/034/012/2171/2177 [illegible]

AUTHOR: Vulis, L.A.; Dzhaugashtin, K. Ye.

TITLE: Magnetohydrodynamic Couette flow

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 34, no. 12, 1964, 2171-2177

TOPIC TAGS: magnetohydrodynamics, mhd flow, mhd hypersonic flow

ABSTRACT: It is noted that in earlier studies of hypersonic Couette flow [illegible] ... dependences of the friction and heat ... there was no consistent ... [illegible]

[illegible]

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L 23819-65

ACCESSION NR: AP5000842

equations is replaced by a system of transcendental algebraic equations by a single transformation. This also takes care of the boundary conditions, for the basis parameter - the distance between the parallel plates - is brought in from the start in the form of a ratio to replace the differential operators. General solution of

the steady states one can make use of the complete solution of the system for the case of constant conductivity. Analysis of the different factors with the aid of the deduced equations leads to results consistent with those of Bush as regards variation of the friction and heat transfer in a boundary layer. Orig art. has: 39 formulas and figures

ASSOCIATION: none

SUBMITTED: 15Jul63 ENCL: 00 SUB CODE: ME

NR REF SOV: 005 OTHER: 003

2/2

L 41148-65 EWT(1)/EPF(c)/EPF(r)-2/EWG(m)/EPR Pr-4/Ps-4/Pu-4 WW/CS

ACCESSION NR: AT S 0000 64 000 000 158 167

... sanov, A. T.

... with their ... equations ...

... metody i sredstva resheniya kraevykh zadach. Analog methods ...

TOPIC TAGS: integrator, electrointegrator, static integrator, heat transfer ... simulation, analog computer

ABSTRACT: The paper considers a heat transfer problem in the presence of various ... movement of the boundary ...

$$\frac{\partial}{\partial t} = a_1 \frac{\partial^2}{\partial x^2} \quad (2)$$

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$$\lambda_1 \frac{\partial u_1}{\partial x} - \lambda_2 \frac{\partial u_2}{\partial x} = \varrho L \frac{d\xi}{dt}, \tag{3}$$

$$u_1(0, t) = u(t).$$

$$u_1(\xi, t) = u_2(\xi, t) = u_{m}, \tag{4}$$

$$u(x, 0) = f(x)$$

The author constructs an integrator element shown in Fig. 1 of the Enclosure which implements the finite difference scheme

VULIS, L. A. (Leningrad); KARELIN, V. Ye.; PALATNIK, I. B.; SAKIPOV, Z.;
USTIMENKO, B. P. (Alma-Ata)

"Laws of propagation of turbulent compressible gas jets"

report presented at the 2nd All-Union Congress on Theoretical and Applied Mechanics, Moscow, 29 Jan - 5 Feb 1964.

VULIS, L. A.; DZHAUGASHTIN, K. Ye. (Leningrad)

"The elementary theory of hysteresis effect in magnetogasdynamics"

report presented at the 2nd All-Union Congress on Theoretical and Applied Mechanics, Moscow, 29 Jan - 5 Feb 1964.

VULIS, L.A.; DZHAUGASHTIN, K.Ye.

Magnetogasdynamics of Couette flow. Zhur.tekh.fiz. 34 no.12:2171-2177 D '64. (MIRA 18:2)

VULIS, Lev Abramovich; KASHKAROV, Vasiliy Petrovich; PATRON, V.Z., red.

[Theory of jets of viscous fluids] Teoriia strui viazkoi zhidkosti. Moskva, Nauka, 1965. 431 p. (MIRA 18:9)

APPROVED FOR RELEASE: 09/01/2001 CIA-RDP86-00513R001961310013-6"

L 16702-66 EWP(m)/EWT(1)/ETC(m)-6/EWA(d)/EWA(1) WW

ACC NR: AP6003207 SOURCE CODE: UR/0382/65/000/004/0067/0074

AUTHOR: Vulis, L. A.; Dzhaugashtin, K. Ye.

ORG: none

76
B

TITLE: A semibounded conducting fluid stream

SOURCE: Magnitnaya gidrodinamika, no. 4, 1965, 67-74

TOPIC TAGS: Reynolds number, heat diffusion, MHD flow, conductive fluid, fluid flow, magnetic field, motion equation

ABSTRACT: The stationary problem of incompressible viscose conducting liquid moving as a stream along a flat surface is considered. The problem considers a flow in a magnetic field normal to the surface which constricts the flow to a semibounded space. The magnetic field value restricts the Reynolds number values to much less than unity. The usual equations of motion are solved by use of similarity transformations and iterative approximations where the zero order solution is that for the nonconducting fluid. It is shown that the velocity profile is given quite accurately by a single iteration. The solutions are plotted for several values of the parameter which determines the strength of the magnetic interaction. 1,55 44

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L 16702-66
ACC NR: AP6003207

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This problem is further extended by the inclusion of heat diffusion. Solutions for three different sets of boundary conditions are given. The resulting temperature profiles are plotted in terms of several sets of appropriate parameters. Orig. art. has: 4 figures, 35 formulas.

SUB CODE: 20/ SUBM DATE: 15Mar65/ ORIG REF: 004/ OTH REF: 001

Card 2/2 *nst*

L 16844-66 EWT(1)/EWP(m)/EWA(d)/ETC(m)-6/EWA(1) WW

ACC NR: AM6001041 Monograph UR/

Vulis, Lev Abramovich; Kashkarov, Vasiliy Petrovich

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78

Theory of a jet viscous fluid (Teoriya struy vyazkoy zhidkosti) Moscow, Izd-vo "Nauka," 1965. 429 p. illus., biblio. Errata slip inserted. 4600 copies printed. B+1

TOPIC TAGS: fluid mechanics, gas jet, jet stream, turbulent jet, diffusion flame, wall jet, wake flow, heat transfer, boundary layer, magnetohydrodynamics, jet flow, Navier Stokes equation

PURPOSE AND COVERAGE: This book will be of particular interest to persons concerned with the problems of fluid jet streams. The book is devoted to the results of 155 investigations of a broad and widespread category of incompressible fluid motions in the form of laminar and turbulent jets. The development of computational methods applicable to an important type of jet streams and based on a consistent and systematic study of jet flows with a theoretical approach is the aim of this monograph. There are four parts to the book, including a foreword and an introduction. The first part deals with the solutions of jet problems based on the exact Navier-Stokes equations for incompressible fluids and, in particular, with the Landau investigation of the propagation of a submerged axially symmetric viscous fluid jet issuing from a thin tube. The second part contains a detailed analysis of laminar jet streams of an incompressible fluid by methods of boundary layer theory. In addition to free jets flowing into a stationary medium or into homogeneous wake flows, semibounded jets (wall jets) are considered. Turbulent jets of liquids and gases are the subjects of the third part, in which self-similar

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ACC NR: AM6001041

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solutions for free and wall jet sources are investigated. It also contains detailed experimental data obtained under the guidance of one of the authors in thermophysical laboratories in Alma Ata for comparison with the theoretical results. The fourth part deals with certain theoretical and experimental problems of jet streams which may be regarded as complementary to the main topics treated in this book. Among them are complex turbulent jet streams, patterns of diffusion flames, and jets in magnetohydrodynamics. The authors thank K. E. Dzhaugashtin and L. P. Yarin for their help in selecting data and in writing Chapters 17 and 18, and also G. N. Abramovich and G. Yu. Stepanov for their comments.

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ACC NR: AM6001041

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APPROVED FOR RELEASE: 09/01/2001 CIA-RDP86-00513R001961310013-6"

L 16844-66

ACC NR: AM6001041

SUB CODE: 20 SUBM DATE: 09Jun65/ ORIG REF: 206/ OTH REF: 119

Card 4/4 mc

L 22302-66 EWP(m)/EWT(1)/EWA(d)/EWA(1) GS

ACC NR: AT6006907 SOURCE CODE: UR/0000/65/000/000/0120/0128

AUTHOR: Vulis, L. A. (Leningrad)

58
B+1

ORG: none

TITLE: Nonuniform energy distribution in the flow of a gas

SOURCE: Teplo- i massoperenos. t. II: Teplo- i massoperenos pri vzaimodeystvii tel s potokami zhidkostey i gazov (Heat and mass transfer. v. 2: Heat and mass transfer in the interaction of bodies with liquid and gas flows). Minsk, Nauka i tekhnika, 1965, 120-128

TOPIC TAGS: gas flow, gas dynamics, shock wave

ABSTRACT: A nonuniform distribution of energy is characteristic of the rapid movement of a gas. The article surveys several examples of local redistribution of energy and considers the physical nature of such effects. The first case considered is the flow of a gas from a shock tube. After a mathematical development, the article gives a relationship for the values of the stagnation temperature as a linear function of the square of the Mach number. The result is applied to calculation of flame fronts. In general, the article concludes that the effect of local redistribution is small in the dynamic problem and can be

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ACC NR: AT6006907

neglected in calculation of the motion of a gas. It is however important in calculation of the thermal problem. Orig. art. has: 4 figures.

SUB CODE: 20/ SUBM DATE: 09Nov65/ ORIG REF: 011/ OTH REF: 005

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L 31526-66 EWT(1)/EWP(m)/T-2 IJP(c)

ACC NR: AP6008829 SOURCE CODE: UR/0294/66/004/001/0059/0065

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B

AUTHOR: Vulis, L. A.; Dzhaugashtin, K. Ye.

ORG: Leningrad Higher Naval Engineering College (Leningradskoye vyssheye voyenno-morskoye inzhenernoye uchilishche)

TITLE: Hysteresis phenomena during the flow of a conducting gas in an MHD-energy converter channel

SOURCE: Teplofizika vysokikh temperatur, v. 4, no. 1, 1966, 59-65

TOPIC TAGS: magnetohydrodynamics, MHD flow, conducting gas, gas flow, magnetic hysteresis

ABSTRACT: One of the characteristics of MHD flows of a low-temperature plasma is well-defined temperature dependence of conductivity. The nonlinearity due to this may lead to an ambiguity of steady states and to unique hysteresis effects. For MHD flows such effects were detected elsewhere in the course of numerical calculations of hypersonic motions. An elementary theory of the problem for Couette flow has been published. Inasmuch as the nature of the phenomena investigated, generally speaking, is not related to a specific type of flow, it is natural to assume that an analogous manifestation of nonlinearity is found in cases other than those studied in relation to hypersonic motions. From this viewpoint, the present authors investigate the practically important case of the flow of a conducting gas

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ACC NR: AP6008829

in an MHD-energy converter channel. The study is made in the framework of a quasiuni-dimensional steady-state flow at low values of the magnetic Reynolds number and Hall parameter. The study is restricted to a general, primarily qualitative statement of the problem and some examples which allow the presentation of the final results in a simple form. Detailed data for specific cases may be obtained by means of numerical calculations, unrelated to extensive simplification of the problem. Orig. art. has: 7 figures and 20 formulas.

SUB CODE: 20 / SUBM DATE: 12Oct64 / ORIG REF: 004 / OTH REF: 002

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